



DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
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From: Commander, Naval Facilities Engineering Command, Engineering Innovation and Criteria Office (EICO)

To: Distribution

Subj: ITG 01-01 INTERIM TECHNICAL GUIDANCE (ITG) "ELEVATOR DESIGN"

Ref: (a) Design Manual-3.09, Elevators, Escalators, Dumbwaiters, Access Lifts and Pneumatic Tube Systems
(b) NAVFAC Guide Specifications (NFGS) – 14210, Electric Traction Elevators
(c) NAVFAC Guide Specifications (NFGS) – 14240, Hydraulic Elevators
(d) Maintenance and Operations Manual, MO-118, Inspection of Vertical Transportation Equipment

Encl: (1) NAVFAC Elevator Design Guide dtd 10 JAN 2001

1. **Purpose.** To provide interim technical guidance for provision of elevators, including the coordination of design efforts among the various design disciplines. The guidance may be retained for record purposes until it is incorporated into the criteria as noted in paragraph 4.

2. **Background.** Elevators are required to be provided at certain locations, by statutes, regulations, codes, and Navy criteria. Examination of the existing Navy criteria, construction and inspection reports of less than satisfactory installations, and excessive change orders has resulted in the refinement of elevator design procedures.

3. **Discussion.** See enclosure (1). It supplements reference (a), and coordinates the functional requirements among the various design disciplines.

4. **Criteria.** The NAVFAC Criteria Office will revise the appropriate sections of references (a) through (d), as appropriate.

5. **Coordination.** This ITG has been coordinated with NAVFAC HQ Fire Protection, and Safety Offices.

6. **Action.**

a. **Design and Construction.** Design all new projects using this guidance. Revise all projects under design, but not completed, to comply with the guidance where funds and schedule permit. Modify Navy projects currently under construction and amend advertised construction projects to conform to the enclosed guidance where funds and schedule permit. Use this guidance to the extent practicable for all elevator repair and replacement projects.

Subj: ELEVATOR DESIGN GUIDE, INTERIM TECHNICAL GUIDANCE (ITG)

b. Maintenance and Operations. Continue to maintain and operate in accordance with MO-118.

7. Points of Contact. For additional information concerning elevators, the following points of contact are provided:

a. NAVFAC Criteria Office – Mr. Thomas J. Harris, P.E. at DSN 262-4206, commercial 757-322-4206, FAX at 4416 or via Internet at harristj@efdlant.navfac.navy.mil;

b. NAVFAC Elevator Program Manager – Mr. Kevin Morse at DSN 262-4653, commercial 757-322-4653, or via the Internet at morsekp@efdlant.navfac.navy.mil.

c. NAVFAC CHIEF FIRE PROTECTION ENGINEER – Mr. Joseph Simone at DSN 325-9177, commercial 202-685-9177, Fax at 1577, or via Internet at simoneja@hq.navfac.navy.mil.


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NAVFAC ELEVATOR DESIGN GUIDE

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CHAPTER 1

INTRODUCTION

1-1 Purpose and Scope. This document is intended to reflect Navy policy regarding design and construction of elevators. In addition, these requirements compliment non-governmental standards such as those published by ASME and NFPA. This document has been developed to assist architects and engineers in the proper design of Navy facility elevators. Because elevators are complex multi-disciplined products, guidance is needed to consolidate the Navy elevator criteria and help the architectural and engineering disciplines understand their roles in elevator design.

1-2 Applicability. The requirements of this document apply to all elevators in Navy facilities.

1-3 References. Applicable references are listed in each chapter.

1-4 Content and Format. This guidance is arranged by design disciplines, and within each design discipline the chapter is arranged by the major elevator component. This arrangement serves three purposes; (1) allows easy and ready access to elevator requirements needed by each designer; (2) allows a checklist format for the designer to assure all requirements have been met; (3) allows the designer in charge of the overall facility to understand the roles of each of his architects and engineers by providing a tool for coordination of the design effort.

CHAPTER 2

ARCHITECTURAL ELEVATOR DESIGN GUIDE

2-1 Design Reference Documents

- 2-1.1 Design elevator, hoistway, and machine room in accordance with the current versions of the following reference documents:

ADA/ABA - American with Disabilities Act (ADA) Accessibility Guide Lines for Building And Facilities; Architectural Barriers Act (ABA) Accessibility Guide Lines.

ADAAG - American Disabilities Act Accessibility Guide Lines

ASME A17.1, - American Society of Mechanical Engineers Safety Code for Elevators and Escalators.

ASME A17.2.1, - Inspector's Manual for Electric Elevators.

ASME A17.2.2, - Inspector's Manual for Hydraulic Elevators.

ASME A17.2.3, - Inspector's Manual for Escalators.

ASME A17.3, - Safety Code for Existing Elevators and Escalators
(For designing changes to existing Elevator/Escalator Systems)

NAVFAC PDPS 94-01 – Barrier Free Design Accessibility Requirements

NEII - National Elevator Industry, Inc. (1992) –Vertical Transportation Standards

NFGS - 14210 - NAVFAC Guide Specifications Section 14210,
"Electric Traction Elevators"

NFGS - 14240 - NAVFAC Guide Specifications Section 14240,
"Hydraulic Elevators"

NFPA 70 - National Electric Code (NEC)

NFPA 80 - Fire Door and Fire Windows

UBC - Uniform Building Code

UFAS - Uniform Federal Accessibility Standards

- 2-1.2 The requirements and guidance provided in this Architectural Elevator Design Guide are applicable to both continental United States and overseas projects, however the technical/commercial reference standards (ASME, NEC, ADAAG) listed in this document will be different in Europe.
- 2-1.3 Sprinkler protection shall not be provided for elevator hoistways, pit, and machine rooms of Italian construction projects. Italian law does not allow sprinklers in these areas.

2-2 General Design Guidance

2-2.1 Consult with the NAVFAC Elevator Program Manager, EFD Elevator Program Manager, or PWC Elevator Inspector during the preliminary design of facilities that include elevators. The Navy elevator experts can be located by using phone numbers and e-mail addresses from Chapter 6 “Specifications Elevator Design Guide.”

2-2.2 Type of elevators addressed:

a. Hydraulic

(1) Direct plunger: A car is connected to the top of a single section piston, that moves up and down in a cylinder, which is below ground level. The car moves up when hydraulic fluid is pumped into the cylinder from a reservoir, raising the piston. Hydraulic systems are used primarily in low-rise installations where moderate car speed is required, up to 150 feet per minute. The typical extent of travel is 40 feet (12192 mm), do not exceed a maximum travel length of 44 feet (13411 mm) or a maximum building height of four floors for Navy facilities.

(2) Holeless: The car is connected on each side with a single section piston that moves up and down in a cylinder, which is mounted on top of the pit floor. The car moves up when hydraulic fluid is pumped into the cylinder from a reservoir, raising the piston. Car speed up to 125 feet per minute (38.1 meters per minute) is attained and maximum travel length is 12 feet (3658 mm).

(3) Roped: The car is supported by steel hoist ropes and sheave, which are moved up and down by a holeless single section piston in a cylinder. Car speed up to 150 feet per minute is attained and maximum travel length is 48 feet (14630 mm). The use of roped hydraulic elevators for Navy facilities must be approved by the NAVFAC Elevator Program Manager.

b. Electric Traction

(1) Geared: The car is supported in a hoistway by steel hoist ropes, a sheave, and a counterweight. The car and counterweight ride along vertical guide rails. In a geared machine, the drive sheave is connected to the motor shaft through gears in a gearbox. This equipment is designed for mid-rise applications of five or more floors requiring typical speeds up to 350 feet per minute.

(2) Gearless: The car is supported in a hoistway by steel hoist ropes, sheaves, and a counterweight. The car, counterweight and guide rails operate like those in a geared system. The gearless machine has a motor that connects directly to the shaft of the drive sheave. The equipment is designed for high-rise applications of 10 or more floors requiring typical speeds of 500 or more feet

per minute.

- 2-2.3 Hydraulic and electric traction elevators utilize controllers to coordinate systems and passenger calls. These elevators utilize either of these two types of controllers:
 - a. Microprocessor: Computer logic control is the standard for both electric traction and hydraulic elevators.
 - b. Relay logic: Mechanical electro-magnetic controller relays control the operation of the elevator.
- 2-2.4 Determine the need for elevators by compliance with the most stringent requirements of the following criteria:
 - a. NAVFAC PDPS 94-01 which requires facility designs to comply with UFAS and ADAAG, whichever one provide the greatest accessibility. The UFAS and ADAAG documents will be combined and superseded by the ADA/ABA in the near future. The UFAS and ADAAG documents are available at web site <http://www.access-board.gov>, choose “Publications”. The draft ADA/ABA document is available at web site <http://www.access-board.gov/ada-aba/guidenprm.htm>.
 - b. Comply with the applicable facility design criteria for the facility building type under design. An example of this kind of criteria is the Military Handbook; MIL-HDBK-1036A, “Bachelor Housing” for Bachelor Quarters.
 - c. Comply with the Facility Design Program Requirements for the specific project. An example of this kind of requirement is the using Activity’s desire to ensure access for persons with disabilities to programs, services and employment. Another example is the using Activity’s need for vertical transportation of furniture or equipment.

2-3 Machine Room

- 2-3.1 Locate hydraulic elevator machine room on the lowest level served by the elevator and directly adjacent to the hoistway. Machine room and hoistway must be on the same side of any building expansion joint.
- 2-3.2 Provide plans and sections for elevator machine room. Show roof top machine room on elevations and plans for electric traction elevators.
- 2-3.3 Indicate 2 hour fire rating for floor, walls and ceiling construction. If required, indicate stair access, no ladders.
- 2-3.4 Machine room door (exiting to the interior of the building) shall be “B” Label, fire rated 1 ½ hour with automatic closure, latching door hardware, panic hardware exit device from interior of room, key operated hardware from outside of room only. Machine room

door shall not contain ventilation louvers or undercuts in excess of NFPA 80, Section 1-11.4 requirements. Provide threshold if floor finish under door is combustible, in accordance with NFPA 80, Section 1-11.2.

- 2-3.5 There are two types of elevator controllers, microprocessor and relay logic. Microprocessors are typical in most installations. However, if you have a base that is located in a remote location or subject to erratic building power supply, a relay logic controller may be a better choice. Confirm elevator controller type with local Public Works and Base Maintenance Department.
- 2-3.6 Determine if emergency power is required. Emergency power is usually needed in health care facilities (with bed confinement) or high rise facilities (greater than 75'-0" (22860 mm) from ground floor to highest occupied floor). If emergency power is required, coordinate requirements with the Electrical Engineer (for example, the number of elevators to run on emergency power at the same time).
- 2-3.7 Most electric traction elevator machines are lifted up the elevator hoistway to gain access to roof top machine rooms during construction. Provide a lifting beam at the top of the machine room to accommodate installation of the elevator machine.
- 2-3.8 Provide an unobstructed 7'-0" (2133 mm) minimum vertical clearance below all solid items (including the lifting beam for electric traction elevators) throughout the elevator machine room. Provide a maximum machine floor to ceiling height of 12'-0" (3658 mm). Provide a suspended gypsum board or plaster ceiling if a ceiling is required below the structural ceiling.
- 2-3.9 The machine room design shall contain only equipment related to the elevator operation as required by ASME A17.1.
- 2-3.10 Pipes, ducts and conduit not related to the elevator system are not allowed to penetrate the machine room.

2-4 Elevator Pit

- 2-4.1 Indicate pit ladder and hoist way sump pump pit on floor plan of the elevator pit. Locate ladder on hoist way sidewall closest to hoist way door opening. Provide sump pit and sump pumps on all elevators.
- 2-4.2 Detail sump pit large enough to fully enclose submersible sump pump below hoist way pit floor level. Minimum size of elevator sump pump pit is 1' - 6" (457 mm) wide x 1' - 6" (457 mm) long x 2' - 0" (609 mm) deep, larger is preferred. Provide fully supported, removable grate cover, flush with elevator hoist way pit floor.
- 2-4.3 Indicate water stops in the walls and waterproofing for elevator pit floor and walls.

- 2-4.4 On hydraulic elevators, sprinkler protection is required in the pit of each elevator. Refer to Chapter 7, “ Fire Protection Elevator Design Guide” for requirements.

2-5 Elevator Hoistway

- 2-5.1 Maximum travel length for direct plunger type hydraulic elevator is 44 feet (13411 mm) or a maximum building height of four floors for Navy facilities, whichever is the lesser.
- 2-5.2 Telescopic hydraulic pistons are not acceptable for Navy facilities. Provide only single section pistons for all hydraulic elevators.
- 2-5.3 Roped hydraulic elevators for Navy facilities must be approved by the NAVFAC Elevator Program Manager.
- 2-5.4 Geared electric traction machines should be used for buildings of five or more floors.
- 2-5.5 Gearless electric traction should be used for buildings of ten floors or more where intensive traffic is anticipated.
- 2-5.6 The elevator code does not allow anything to be installed in the hoistway not related to the elevator operation.
- 2-5.7 Pipes, ducts and conduit not related to the elevator system are not allowed to penetrate the hoistway.
- 2-5.8 Show locations of all support beams required in hoistway. Indicate beams on building sections and details. For multiple elevators in the same hoistway, provide divider beams for guiderail support brackets.
- 2-5.9 Eliminate all ledges (potential personnel standing locations, etc.) in hoistway construction. Provide details which indicate that all horizontal projections and recesses of 2” (50 mm) or more, have been beveled back to hoistway wall at a 75-degree angle downward from horizontal.
- 2-5.10 Provide exterior ventilation of hoistway if the elevator exceeds 15 feet (4572 mm) of travel. To obtain this ventilation, provide a weatherproof louver with a minimum free area of 3 1/2 % of the hoistway horizontal cross sectional area. The louver must have a minimum free area of at least three square feet (0.3 square meters).
- 2-5.11 Detail grouted cast white bronze or nickel silver hoistway sills at elevator landings. Match the material used in the cab sill.
- 2-5.12 Indicate all elevator hoistway door frames grouted to a height of 5 feet (1524 mm).

- 2-5.13 On hydraulic elevators, design clear access for hydraulic oil line between machine room and hoistway. Hydraulic oil lines shall remain in or under conditioned space from end to end and remain within the building footprint. Provide straight pipe run in PVC pipe sleeves for oil spill containment of all buried hydraulic lines between machine room and the hoistway.
- 2-5.14 On hydraulic elevators, sprinkler protection is required at the top of the hoistway when the hydraulic cylinder or supply piping extends above the second finished floor elevation. Refer to Chapter 7, “Fire Protection Elevator Design Guide” for requirements.
- 2-5.15 Coordinate sprinkler and smoke detector requirements with Fire Protection Engineer and Electrical Engineer. Confirm smoke detectors are shown on fire alarm plans and risers.
- 2-5.16 For interior cab dimensions of new elevators being installed in an existing hoistway, insure that the design meets the requirements of ASME A17.1. (Rule 201, Capacity and Loading). Passenger elevators frequently require greater capacity (pound per square foot (kilogram per square meter)) than freight elevators.
- 2-5.17 Indicate 2-hour fire rating for floor, walls, and top of hoistway (when terminated below roof level) construction.
- 2-5.18 If building roof construction is combustible: Item a. below is considered good practice for 2-hour rated hoistways that terminate at the roof level, item b. below is required for 2-hour rated hoistways that terminate below the roof level.
- a. Extend 2 hour rated hoistway through the roof and terminate the top of the hoistway at least 3'-0" (914 mm) above the combustible roof with a 2-hour enclosure, or
 - b. Terminate the 2-hour rated hoistway below the roof level with a 2-hour rated enclosure.
- 2-5.19 If building roof construction is noncombustible: comply with one of the following requirements for top termination of the 2 hour rated hoistway.
- a. Extend 2 hour rated hoistway construction to the underside of the roof deck or slab. Seal wall construction tight to deck or slab and roof construction becomes hoistway termination, or
 - b. Terminate the 2-hour rated hoistway below the rated roof level with a 2-hour rated enclosure.

- 2-5.20 Indicate and note the hoistway walls to be grouted and fire-stopped at top, tight against floor or roof construction decking.
- 2-5.21 Hoistway walls shall be plumb. Wall shall not vary more than one inch (25 mm) within any 60-foot (18-meter) interval of vertical height.

2-6 Elevator Cab

- 2-6.1 Obtain manufacturer's catalog cuts of the elevator performance. Coordinate the following elevator description information with the specification writer and appropriate design discipline(s):
 - a. Rated load
 - b. Rated speed
 - c. Travel length
 - d. Number of stops
 - e. Number of hoistway openings
 - f. Car inside dimension
 - g. Car door opening
 - h. Electrical design requirements
- 2-6.2 Coordinate the cab enclosures and hoistway door finishes with the specification writer:
 - a. Floor finish
 - b. Wall finish and accessories handrails
 - c. Interior face of doors
 - d. Ceiling finish and lighting
 - e. Hoistway doors
 - f. Hoistway frames.
- 2-6.3 The designer and client must decide whether a passenger or freight elevator is most appropriate for the facility. This decision will be based on the anticipated usage. If the elevator will be used to carry people other than a freight handler, it must be designed as a passenger elevator.
- 2-6.4 Design the size of all elevators that carry passengers to accommodate handicapped access in accordance with UFAS and ADAAG. For all buildings of four stories or more in height, provide at least one elevator of size to accommodate emergency medical services in accordance with UBC, Chapter 30.
- 2-6.5 Passenger elevator design/selections: The design of passenger elevators requires obtaining and utilizing the appropriate data and criteria to calculate the correct elevator size and rated load.

- a. Preliminary design and layout of elevators shall be in accordance with National Elevator Industry, Inc. – Vertical Transportation Standards. Copies of this standard may be obtained from; National Elevator Industry, Inc., 400 Frank W. Burr Blvd., Teaneck, NJ 07666-6801; Telephone: (201) 928-2828.
- b. The Final elevator design including the required number of cars, their capacity and car inside dimensions, speed, and operation is to be determined by a traffic study. The following factors will be utilized in this analysis, which should be performed by a qualified elevator consultant.
 - (1). Type and Use of Building
 - (2). Size and Height of Building.
 - (3). Exterior Traffic Consideration
 - (4). Population of Building
 - (5). Anticipated Traffic Flow
- c. Determine minimum rated load of elevator by utilizing attachment #1:
ASME A17.1 Table 207.1.

2-6.6 Freight elevator design/selection: If the elevator will be used to carry passengers and general freight, it must be designed as a passenger elevator. However, if a freight elevator is required, design in accordance with ASME A17.1 (Rule 207. 2 Minimum Rated Load for Freight Elevator).

2-6.7 Provide a cast white bronze or nickel silver car sill. Match the material used in the hoistway sill.

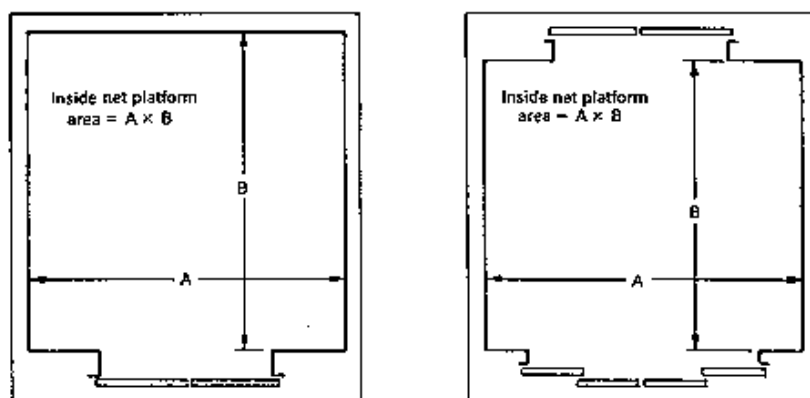


FIG. 207.1 INSIDE NET PLATFORM AREAS FOR PASSENGER ELEVATORS

**TABLE 207.1
MAXIMUM* INSIDE NET PLATFORM AREAS FOR THE VARIOUS RATED LOADS**

Rated Load, lb	Inside Net Platform Area, ft ²	Rated Load, lb	Inside Net Platform Area, ft ²
500	7.0	5,000	50.0
600	8.3	6,000	57.7
700	9.6	7,000	65.3
1,000	13.25	8,000	72.9
1,200	15.6	9,000	80.5
1,500	18.9	10,000	88.0
1,800	22.1	12,000	103.0
2,000	24.2	15,000	125.1
2,500	29.1	18,000	146.9
3,000	33.7	20,000	161.2
3,500	38.0	25,000	196.5
4,000	42.2	30,000	231.0
4,500	46.2		

*To allow for variations in cab designs, an increase in the maximum inside net platform area not exceeding 5% shall be permitted for the various rated loads.

GENERAL NOTE:

1 lb = 0.454 kg

1 ft² = 9.29 E -02 m²

CHAPTER 3

STRUCTURAL ELEVATOR DESIGN GUIDE

3-1 Design Reference Documents

- 3-1.1 Design elevator, hoistway, and machine room in accordance with the current versions of the following reference documents:

ASCE-7 - America Society of Civil Engineers. Minimum Design Loads for Buildings and Other Structures.

ASME A 17.1, - America Society of Mechanical Engineers Safety Code Elevators and Escalators.

FEMA - 302, February 1999 - NEHRP Recommended Provisions for Seismic. Regulations for New Buildings and Other Structures. Part 1 Provisions.

NFGS - 14210 - NAVFAC Guide Specifications Section 14210, "Electric Traction Elevators"

NFGS - 14240 - NAVFAC Guide Specifications Section 14240, "Hydraulic Elevators"

TI 809-04, 31 December 1998 - TRI-Service Instruction, Seismic Design for Buildings.

- 3-1.2 The requirements and guidance provided in this Structural Elevator Design Guide are applicable to both continental United States and overseas projects, however the technical/commercial reference standards (ASME) listed in this document will be different in Europe.

3-2 Design Requirements

- 3-2.1 In all seismicity regions, provide adequate structural support to attach the elements of the elevator support system as required by the elevator manufacturers design and applicable codes. The elevator manufacturers shall design the elements of the elevator support system (all elements that are part of the elevator system, such as the car and counterweight frames, guide rails, supporting brackets and framing, as well as supports and attachments for driving machinery, operating devices, and control equipment) with consideration to lateral seismic forces and displacement of TI 809-04, Paragraph 10-3.h. The elevator shall also comply with the following:
- a. Manufacturer shall design all supports and attachments for machinery and equipment with an a_p equal to 1.0 for rigid and rigidly attached items and equal to 2.5 for nonrigid or flexibly mounted equipment.

- b. In structures conforming to Seismic Design Classification D, E, and F, the manufacturer shall provide guide rail tie brackets and intermediate spreader brackets as specified in TI 809-04, Paragraph 10-3 h.2.
- 3-2.2 Avoid the use of tile or brick hoistway walls, particularly those conforming to Seismic Design Classification D, E, and F.
- 3-2.3 Indicate details for sump pump pit and the impact of the sump pit on the foundation for the structure.
- 3-2.4 Indicate water stops in the walls. Indicate waterproofing for the elevator pit floor and walls if not indicated on the architectural drawings.
- 3-2.5 Avoid locating building expansion joints between the elevator hoistway and elevator room.
- 3-2.6 Design all exterior components of the elevator or machine room to the same requirements used for the facility design. In the absence of structural criteria for the exterior components use ASCE-7.

CHAPTER 4

MECHANICAL

ELEVATOR DESIGN GUIDE

4-1 Design Reference Document

4-1.1 Design elevator, hoistway, and machine room in accordance with the current versions of the following reference documents:

ADAAG - American Disabilities Act Accessibility Guidelines
ASME A17.1, - American Society of Mechanical Engineers Safety Code for Elevators and Escalators.
ASME A17.2.1, - Inspector's Manual for Electric Elevators.
ASME A17.2.2, - Inspector's Manual for Hydraulic Elevators.
ASME A17.2.3, - Inspector's Manual for Escalators.
ASME A17.3, - Safety Code for Existing Elevators and Escalators
(For designing changes to existing Elevator/Escalator Systems)
NFGS - 14210 - NAVFAC Guide Specifications Section 14210,
"Electric Traction Elevators"
NFGS - 14240 - NAVFAC Guide Specifications Section 14240,
"Hydraulic Elevators"
NFPA 70 - National Electric Code (NEC)
NFPA 80 - Fire Door and Fire Windows
UBC - Uniform Building Code
UFAS - Uniform Federal Accessibility Standards

4-1.2 The requirements and guidance provided in this Mechanical Elevator Design Guide are applicable to both continental United States and overseas projects, however the technical/commercial reference standards (ASME, NEC, ADAAG) listed in this document will be different in Europe.

4-1.3 Sprinkler protection shall not be provided for elevators hoistway, pit, and machine rooms of Italian construction projects. Italian law does not allow sprinklers in these areas.

4-2 Machine Room

4-2.1 Indicate ventilation as required by ASME A 17.1 (Rule 101.5, Lighting and Ventilation of Machine Rooms and Machinery Spaces). Provide heating, ventilating, and air-conditioning to elevator machine room to maintain temperature limits between 50 to 90 degrees F (10 to 32 degrees C) as recommended by elevator manufacturers. Air conditioning is required in most conditions; gravity ventilation is not acceptable. Coordinate with Electrical Engineer. Provide emergency power for machine room cooling/ventilating equipment, if the elevator is on emergency power circuit

- 4-2.2 Do not locate equipment, pipes, conduits, and ducts unrelated to the elevator in the hoistway and the machine room. ASME A17.1 (Rule 101.2, Equipment in Machine Rooms).
- 4-2.3 Machine room door (exiting to the interior of the facility) shall be fire rated and shall not contain louvers for ventilation nor undercuts in excess of NFPA 80, Section 1-11.4 requirements.

4-3 Elevator Pit

- 4-3.1 An elevator pit floor drain is not acceptable. Elevator pit must have floor sump pit and pump. Pump to sanitary sewer through a 2" (50 mm) air gap or directly through an oil/water separator to storm sewer, or to grade outside the building line, each in accordance with discharge permits, regulations, and statutes. Coordinate sump pit pump with the Architect, Structural Engineer, and Electrical Engineer.
- 4-3.2 On hydraulic elevators, sprinkler protection is required in the pit of each elevator. Refer to Chapter 7, "Fire Protection Elevator Design Guide" for requirements.
- 4-3.3 Size sump pump for a minimum of 20 gallons (76 liters) per minute. Coordinate pump size with Architect to assure the pump will completely fit within the sump pump pit and function correctly.

4-4 Elevator Hoistway

- 4-4.1 Provide exterior ventilation of hoistway, if the elevator exceeds 15 feet (4572 mm) of travel. To obtain this ventilation, provide a weatherproof louver with a minimum free area of 3 1/2 % of the hoistway horizontal cross sectional area. The louver must have a minimum free area of at least three square feet (0.3 square meters). ASME A17.1 (Rule 100.4, Control of Smoke and Hot Gases).
- 4-4.2 Pipes, ducts, and conduit not directly related to the elevator are not allowed to penetrate the hoistway.
- 4-4.3 On hydraulic elevators, sprinkler protection is required at the top of the hoistway when the hydraulic cylinder or supply piping extends above the second finished floor elevation. Refer to Chapter 7, "Fire Protection Elevator Design Guide" for requirements.

CHAPTER 5

ELECTRICAL

ELEVATOR DESIGN GUIDE

5-1 Design Reference Documents

5-1.1 Design elevator, hoistway, and machine room in accordance with the current versions of the following reference documents:

ADAAG - American Disabilities Act Accessibility Guidelines
ASME A17.1, - American Society of Mechanical Engineers Safety Code for Elevators and Escalators.
ASME A17.2.1, - Inspector's Manual for Electric Elevators.
ASME A17.2.2, - Inspector's Manual for Hydraulic Elevators.
ASME A17.2.3, - Inspector's Manual for Escalators.
ASME A17.3, - Safety Code for Existing Elevators and Escalators
(For designing changes to existing Elevator/Escalator Systems)
NFGS - 14210 - NAVFAC Guide Specifications Section 14210,
"Electric Traction Elevators"
NFGS - 14240 - NAVFAC Guide Specifications Section 14240,
"Hydraulic Elevators"
NFPA 70 - National Electric Code (NEC)
NFPA 99 - Health Care Facilities
NFPA 101 - Life Safety Code
UBC - Uniform Building Code
UFAS - Uniform Federal Accessibility Standards

5-1.2 The requirements and guidance provided in this Electrical Elevator Design Guide are applicable to both continental United States and overseas projects, however the technical/commercial reference standards (ASME, NEC, ADAAG) listed in this document will be different in Europe.

5-2 Firefighters' Service Visual Signal

ASME A17.1 requires the Firefighters' Service visual signal to activate as follows: Smoke detectors located in the elevator machine room, hoistway, and elevator lobby control illumination of the Firefighters' Service visual signal (Firefighters' hat graphic symbol) in the elevator cab. When activated, smoke detectors in the elevator machine room and the elevator hoistway shall cause the Firefighters' Service visual signal to illuminate intermittently (flash) only in the elevator car(s) with equipment located in that machine room or hoistway. When activated, smoke detectors in the enclosed elevator lobbies shall cause the Firefighters' Service visual signal to illuminate with steady illumination only in the elevator car(s) that serves those lobbies. Actuation of any smoke detector shall initiate actuation of the building fire alarm panel.

5-3 Machine Room

- 5-3.1 Provide a shunt trip circuit breaker for each individual elevator's main power and emergency power, if provided, located in the elevator machine room. Circuit breakers shall be capable of being locked in the open position, and shall serve the power and control of the respective elevator. Each shunt trip circuit breaker shall be served by another dedicated breaker in the main distribution electrical panel and in the emergency distribution electrical panel, if provided. Shunt trip breaker(s) shall be operated by the sprinkler flow switch(s) to automatically open the power supply. Power shall be restored manually. NEC 620-51 (a). Sprinkler protection and the related shunt trip breaker shall not be provided for Italian construction projects. Italian law does not allow sprinklers in the hoistway, pit, and machine room.
- 5-3.2 Designer shall consider types of elevator drives specified, i.e., Silicon Controlled Rectifier (SCR), Variable Frequency Drive (VFD), motor generator, etc., and size service and wire for the worse case.
- 5-3.3 The guide specification requires the elevator supplier to provide individual isolation transformers and individual choke reactors for each hoist motor, and filtering of harmonic distortion when SCR or Variable Voltage Variable Frequency (VVVF) AC controllers are utilized.
- 5-3.4 Provide a branch circuit separate from the main elevator power supply, with a fused disconnect switch capable of being locked in the open position, for lights, receptacles, and ventilation for each individual elevator car. As an alternative, a lockable enclosed circuit breaker may be used as the overcurrent protection device. NEC 620-53, NEC 620-22.
- 5-3.5. Locate all disconnecting means for elevator(s) on the inside surface of the machine room wall next to the strike side of the machine room door. Ensure each disconnect is within sight of the elevator equipment it controls.
- 5-3.6 A separate branch circuit shall supply each individual machine room with lighting and receptacles.
- 5-3.7 All 120V receptacles installed in machine room shall be GFI type (Provide at least one duplex receptacle). NEC 620-23 and NEC 620-85.
- 5-3.8 Conductors and optical fibers, located in the machine room, shall be in conduit.
- 5-3.9 Coordinate the need for emergency power with the using activity and the project architect. Emergency power is usually needed for health care facilities (with bed confinement) or high-rise facilities (greater than 75'-0" from ground floor to highest occupied floor). Provide emergency power for health care facilities in accordance with NFPA 99, high-rise facilities in accordance with NFPA 101, and other facilities as required.

- 5-3.10 If emergency power is used:
- a. The disconnecting means required by NEC 620-51, must disconnect the elevator from normal power and from emergency power.
 - b. If more than one elevator is provided, determine (with Activity input) how many elevators are to operate on emergency power.
 - c. Design the emergency power to be able to operate selected elevator(s) at rated loads and rated speeds.
 - d. System design must accommodate automatic sequential operation in order to bring all elevators to the designated floor level, as required by ASME A17.1 (Rule 211.3b Smoke Detectors) and provide selected elevator(s) with emergency power operations.
 - e. Provide manual override switch in main elevator lobby area(s) to override the automatic emergency power selection.
 - f. Provide emergency power for machine room cooling/ventilation equipment and hoistway ventilating equipment, if the elevator is on emergency power circuit.
 - g. Provide an extra set of contacts on transfer switch (when emergency power is provided) and two-conductor 120-volt ac circuit in conduit from these contacts to junction box in machine room,
- 5-3.11 Provide telephone outlet with dedicated line next to each elevator controller for emergency phone service in elevator car. Indicate outlets on telephone riser.
- 5-3.12 Provide machine room smoke detectors to initiate actuation of Firefighters' Service, illuminate intermittently (flash) Firefighters' Service visual signal, and initiate actuation of the building fire alarm panel. Refer to Chapter 7, "Fire Protection Elevator Design Guide" for requirements. Require smoke detectors to be mounted in the machine room by indicating detectors on the electrical drawings, unless shown on separate fire protection drawings. Coordinate with Fire Protection Engineer.
- 5-3.13 Only electrical wiring, raceways and cables used directly in connection with the elevator shall be permitted in the machine room. NEC 620-37.

5-4 Elevator Pit

- 5-4.1 Provide a twist lock simplex receptacle with matching plug, without GFI protection, to supply the permanently installed sump pump. Mount sump pump receptacle 3'-0" (914 mm) above elevator pit floor. Provide pilot lamp to verify circuit is energized. NEC 620-85.

- 5-4.2 Provide a separate branch circuit supplying the hoistway pit lighting and at least one duplex receptacle in the pit. All duplex receptacles in the pit shall be GFI. NEC-24, NEC 620-85. Locate receptacle 5'-0" (1524 mm) above pit floor.
- 5-4.3 Locate light with wire guard more than 4'-0" (1219 mm) above pit floor. Locate light switch on wall inside the hoistway adjacent to the top of the pit ladder. NEC 620-24.
- 5-4.4 When sprinklers are installed in the hoistway, all electrical equipment located less than 4'-0" (1219 mm) above the pit floor shall be weatherproof (NEMA 4) and wiring shall be identified for use in wet locations in accordance with the requirements in NFPA 70.
- 5-4.5 When sprinklers are provided in the elevator pit, activation of the sprinkler is not required to initiate shutdown of elevator power. Refer to Chapter 7, "Fire Protection. Elevator Design Guide" for requirements.

5-5 Elevator Hoistway

- 5-5.1 Only electric wiring, raceways, and cables used directly in connection with the elevator shall be permitted inside the hoistway. NEC 620-37.
- 5-5.2 Conductors and optical fibers located in the hoistway, not including traveling cable, shall be in conduit.
- 5-5.3 Provide smoke detection at the top of the hoistway whenever sprinklers are installed in the hoistway. If provided, smoke detectors located at the top of the hoistway shall initiate actuation of Firefighters' Service, illuminate intermittently (flash) the Firefighters' Service visual signal, and initiate actuation of the building fire alarm panel. Refer to Chapter 7, "Fire Protection Elevator Design Guide" for requirements. Insure that smoke detectors are indicated on the electrical drawings, unless shown on separate fire protection drawings. Coordinate with Fire Protection Engineer.
- 5-5.4 When sprinkler protection is required at the top of the hoistway, actuation of that sprinkler(s) shall initiate operation of the elevator power shunt trip breaker(s). Refer to the Machine Room paragraph earlier in this section and to the Chapter 7 "Fire Protection Elevator Design Guide" for further guidance.

5-6 Elevator Lobby

- 5-6.1 Provide lobby smoke detector to initiate actuation of Firefighters' Service, steady illumination of Firefighters' Service visual signal, and initiate actuation of the building fire alarm panel. Refer to Chapter 7, "Fire Protection Elevator Design Guide" for requirements. Require lobby smoke detectors to be mounted on the ceiling by indicating detectors on the electrical drawings, unless shown on separate fire protection drawings. Coordinate with Fire Protection Engineer.

CHAPTER 6

SPECIFICATIONS

ELEVATOR DESIGN GUIDE

6-1 Design Reference Documents

6-1.1 Design elevator, hoistway, and machine room in accordance with the current version of the following reference documents:

ADAAG –	American Disabilities Act Accessibility Guidelines
ASME A17.1, -	American Society of Mechanical Engineers Safety Code for Elevators and Escalators.
ASME A17.2.1, -	Inspector’s Manual for Electric Elevators.
ASME A17.2.2, -	Inspector’s Manual for Hydraulic Elevators.
ASME A17.2.3, -	Inspector’s Manual for Escalators.
ASME A17.3, -	Safety Code for Existing Elevators and Escalators (For designing changes to existing Elevator/Escalator Systems)
NFGS 14210 -	Electric Traction Elevator
NFGS 14240 -	Hydraulic Elevators
NFPA 70 -	National Electric Code (NEC)
UBC -	Uniform Building Code
UFAS -	Uniform Federal Accessibility Standards

6-1.2 The requirements and guidance provided in this Specifications Elevator Design Guide are applicable to both continental United States and overseas projects, however the technical/commercial reference standards (ASME) listed in this document will be different in Europe.

6-2 Specification Requirements

- 6-2.1 Utilize the most current version of the NAVFAC Elevator Guide Specifications to specify the project elevator. The NAVFAC Guide Specifications (NFGS) are available on the Construction Criteria Base (CCB) or NAVFAC homepage at <http://criteria.navy.mil/criteria> and choose “Guide Specs”. Do not use previously edited versions of the guide specification for a new job. Start from the most current version of the guide specifications to assure all updated changes are incorporated in the guide specifications. Any editing of non-bracketed paragraphs within the NAVFAC Guide Specification shall be approved through the NAVFAC Elevator Program.
- 6-2.2 Incorporate all current LANTDIV Interim Specifications Revisions (ISR) into the prefinal edited project specifications. These ISR changes are available at the LANTDIV homepage at the following address: http://www.efdlant.navy.mil/lantops_04/home.htm , choose “Specifications”, then “The Specification Preparation Manual”.

- 6-2.3 Design/Build RFP documents should utilize the entire current NAVFAC Guide Specification. Do not attempt to abbreviate or write a performance specification for elevators.
- 6-2.4 If you have any Navy or Local code compliance questions that cannot be answered by in-house expertise or an elevator consultant, contact the NAVFAC Elevator Program Manager or an EFD Elevator Program Manager or a PWC Elevator Inspector for assistance. The NAVFAC Elevator Program Manager, Mr. Kevin Morse (Code 1611K), can be reached by telephone at (757) 322-4653 or by E-mail at MorseKP@efdlant.navfac.navy.mil. The SOUTHWEST Division Elevator Program Manager, Mr. Harold Tompkins, can be reached by telephone at (415) 244-3074, Fax (415) 244-3090. The Norfolk PWC Elevator Inspector, Mr. Dale Hughes, can be reached by telephone at (757) 445-2086 or by E-mail at dhuges@po2.pwc.com. The NAS PAX, Patuxent River, Maryland Elevator Inspector, Mr. Bill Snyder, can be reached by telephone at (301) 757-4902, Fax (301) 342-3700, or by E-mail at snyderwm@navair.navy.mil
- 6-2.5 Design of elevators is a multidisciplinary design function; therefore, input from architectural, structural, mechanical, and electrical disciplines is required for a successfully written specification or review of the elevator shop drawings.
- 6-2.6 If difficulties arise from the use of this NAVFAC Elevator Design Guide or the NFGS Sections 14210, "Electric Traction Elevators" or 14240, "Hydraulic Elevator," please contact LANTDIV to make the authors aware of any needed changes in these elevator documents. The point of contact is Mr. Peter Byrne; R. A. (Code 4062) and he can be reached at (757) 322-4310 or by E-mail at BrynePR@efdlant.navfac.navy.mil.

CHAPTER 7

FIRE PROTECTION ELEVATOR DESIGN GUIDE

7-1 Design Reference Documents

7-1.1 Design elevator, hoistway, and machine room in accordance with the current versions of the following reference documents:

ADAAG -	American Disabilities Act Accessibility Standards
ASME A17.1, -	American Society of Mechanical Engineers Safety Code for Elevators and Escalators.
ASME A17.2.1, -	Inspector's Manual for Electric Elevators.
ASME A17.2.2, -	Inspector's Manual for Hydraulic Elevators.
ASME A17.2.3, -	Inspector's Manual for Escalators.
ASME A17.3, -	Safety Code for Existing Elevators and Escalators (For designing changes to existing Elevator/Escalator Systems)
NFGS - 14210 -	NAVFAC Guide Specifications Section 14210, "Electric Traction Elevators"
NFGS - 14240 -	NAVFAC Guide Specifications Section 14240, "Hydraulic Elevators"
NFPA 13 -	Standard for the Installation of Sprinkler Systems
NFPA 70 -	National Electric Code (NEC)
UBC -	Uniform Building Code
UFAS -	Uniform Federal Accessibility Standards

7-1.2 The requirements and guidance provided in this Fire Protection Elevator Design Guide are applicable to both continental United States and overseas projects, however the technical/commercial reference standards (ASME, NEC, ADAAG) listed in this document will be different in Europe.

7-1.3 Sprinkler protection shall not be provided for elevators hoistway, pit, and machine rooms of Italian construction projects. Italian law does not allow sprinklers in these areas.

7-2 Design Requirements

7-2.1 Provide dual-contact smoke detectors or addressable fire alarm system smoke detectors and control modules at:

- a. All elevator lobbies.
- b. Top of the hoistway. (Only if sprinklers are provided at the top of the hoistway).
- c. Elevator machine room.

Smoke detectors are specified in Section 13852, "Interior Fire Detection and Alarm System," or Section 13855, "Analog/Addressable Interior Fire Alarm System," including conduit and wiring from each smoke detector to elevator controller. In elevator section, provide connections to elevator controls, which will, when smoke is detected by any smoke detector, activate visual and audible signals and send each elevator to the designated floor as required by ASME A17.1 (Rule 211.3b, Smoke Detectors). Indicate detectors and connections on fire protection drawings or on electrical drawings if fire protection drawings are not provided. Coordinate with Electrical Engineer.

- 7-2.2 For electric traction elevator with 2-hour fire rated hoistway, sprinkler(s) are not required by code for the hoistway. Sprinklers are required in the electric traction elevator machine room (except in Italy). Actuation of the flow switch shall remove power to the elevator by shunt trip breaker operation. The flow switch shall have no time delay.
- 7-2.3 In buildings protected with an automatic sprinkler system, provide protection of hydraulic elevator installations as follows (except in Italy):
- a. Machine Room: Provide a sprinkler(s) with sprinkler guards in the machine room. Provide a supervised shut-off valve, check valve, flow switch, and test valve in the sprinkler line supplying the machine room. These items shall be located outside of and adjacent to the machine room. Actuation of the flow switch shall remove power to the elevator by shunt trip breaker operation. The flow switch shall have no time delay. Coordinate with Electrical Engineer.
 - b. Elevator Pit: Provide a sidewall sprinkler(s) with sprinkler guards in the pit for hydraulic elevators. Locate the sprinkler no more than 2'-0" (609 mm) above the pit floor. Provide a supervised shut-off valve in the sprinkler line supplying the pit. Locate the valve outside of and adjacent to the pit. Actuation of the pit sprinkler shall not disconnect power to the elevator.
 - c. Elevator Hoistway: Provide a sprinkler(s) at the top of the hoistway for hydraulic elevators with cylinder or supply piping extending above the second finished floor elevation. Provide a supervised shut-off valve, check valve, flow switch, and test valve in the sprinkler line supplying the hoistway. These items shall be located outside of and adjacent to the hoistway. Actuation of the flow switch shall disconnect power to the elevator by shunt trip breaker operation. Flow switch shall have no time delay. Coordinate with Electrical Engineer.
 - d. Test Valve: Provide inspector's test connection for each flow switch associated with the elevator machine room and/or elevator hoistway sprinklers. Locate the test connection outside the rated enclosure. Route test connection piping to a floor drain location that can accept full flow or where water may be discharged without property damage. Discharge to a floor drain shall be permitted only if the drain is sized to accommodate full flow. Discharge to janitor sinks or similar plumbing fixtures is not permitted.

7-2.4 Coordinate the requirements of the elevator specification section with the applicable fire protection systems specifications as listed below:

- a. Section 13852, “Interior Fire Detection and Alarm System”
- b. Section 13855, “Analog/Addressable Interior Fire Alarm System”
- c. Section 13930, “Wet-Pipe Fire Suppression Sprinklers”
- d. Section 16402. “Interior Distribution System”

7-3 Fire Resistant Construction

7-3.1 Coordinate 2 hours fire resistant construction requirements with Chapter Two, “Architectural Elevator Design Guide.”

7-4 Fire Protection Requirement Summary

7-4.1 A summary of the NAVFAC Sprinkler and Smoke Detector requirements are attached in table titled 7-4.1, "NAVFAC Fire Protection Requirements for Elevators Summary Table."

7-4.1 NAVFAC ELEVATOR FIRE PROTECTION REQUIREMENTS SUMMARY
TABLE

ELECTRIC ELEVATOR		
ROOM/AREA	PROVIDE SPRINKLER (NOT APPLICABLE FOR UNSPRINKLERED BUILDING)	PROVIDE SMOKE DETECTOR TO INITIATE ELEVATOR FIREFIGHTER'S SERVICE AND BUILDING FIRE ALARM SYSTEM
PENTHOUSE MACHINE ROOM	YES *	YES
ELEVATOR LOBBIES	YES	YES
PIT AREA	NO	NO
TOP OF HOISTWAY	NO **	NO **

DIRECT PLUNGER HYDRAULIC ELEVATOR (NOT TO EXCEED 44' OF TRAVEL)

MACHINE ROOM	YES *	YES
ELEVATOR LOBBIES	YES	YES
PIT AREA	YES *	NO
TOP OF HOISTWAY	NO **	NO **

HOLELESS HYDRAULIC ELEVATOR (NOT TO EXCEED 12' OF TRAVEL)

MACHINE ROOM	YES *	YES
ELEVATOR LOBBIES	YES	YES
PIT AREA	YES *	NO
TOP OF HOISTWAY	YES *	YES

* Italian law prohibits sprinklers in elevator hoistway and machine room.

** Provide sprinklers and smoke detector where existing hoistway walls are not 2 hour rated, or existing elevator cab does not meet flame spread or smoke development requirements of ASME A17.1. This situation may occur in historical building renovations.